## [CLAIMS]

1. A transmitter in a Direct Sequence Code Division Multiple Access (DS/CDMA) system, the transmitter comprising:

a PN sequence generator for generating multiple Pseudo ~~random~~ Noise (PN) sequences;

a space-time encoder for selecting two PN sequences from the multiple PN sequences to construct Space-Time Trellis Codes (STTC), and space-time encoding data received from a data source according to the space-time trellis codes to output an M-ary data symbol;

first and second modulators for modulating the space-time encoded data according to the space-time trellis codes; and

first and second multiple transmit antennas for wirelessly transmitting outputs of the first and second modulators, respectively.

2. The transmitter according to claim 1, wherein the PN sequence generator generates M/2+1 PN sequences for the space-time encoding.

3. The transmitter according to claim 1, wherein each data frame transmitted from the data source includes $\log_2 M$ bits for transmission of the M-ary data symbol.

4. The transmitter according to claim 3, wherein one bit of the $\log_2 M$ bits of the data frame is used to determine polarity of parallel transitions of inputs to

the first and second modulators.

5. The transmitter according to claim 1, wherein the space-time encoder transmits the M-ary data symbol in each transmission.

6. The transmitter according to claim 1, wherein the space-time encoder selects two PN sequences from the multiple PN sequences to space-time encode $\log_2 M-1$ bits.

7. A receiver in a Direct Sequence Code Division Multiple Access (DS/CDMA) system, the receiver comprising:

at least one receive antenna for receiving a space-time encoded signal through multiple paths;

a plurality of received data processing units for despreading data received from each of the at least one receive antenna into a plurality of PN sequences, multiplying the PN sequences respectively by complex conjugates of fading coefficients, and taking real parts of the multiplied PN sequences;

a plurality of adders for adding together signals output from the plurality of received data processing units; and

a space-time decoder for decoding signals output from the plurality of adders.

8. The receiver according to claim 7, further comprising a baseband filter for down-converting the decoded data into baseband data.

9. The receiver according to claim 7, wherein a signal $\gamma^j(t,\tau)$ output from a j-th receive antenna of a plurality of receive antennas at time t has a value obtained by adding noise to the sum of spread signals multiplied by fading gains corresponding to the j-th receive antenna, the signal $\gamma^j(t,\tau)$ being expressed by the following equation:

$$\gamma^j(t,\tau)=\sum_{i=1}^{n}\alpha_{i,j}c^i(t,\tau)+\eta^i(t,\tau),$$

where "$\tau(\in 0,1,\ldots,N-1)$" denotes chip time index where "N" denotes a PN sequence length, "$c^j(t,\tau)$" denotes an input to an i-th modulator, which is to be transmitted through an i-th transmit antenna after modulation, "$\alpha_{i,j}$" is a path gain from the i-th transmit antenna to the j-th receive antenna, and "$\eta^j(t,\tau)$" denotes noise at time t and at chip time τ.

10. The receiver according to claim 9, wherein the noise "$\eta^j(t,\tau)$" at time t and at chip time τ is modeled as a zero-mean complex Gaussian random variable with $E|\eta^j(t,\tau)|^2=N_0$.

11. The receiver according to claim 9, wherein the coefficient "$\alpha_{i,j}$" corresponds to independent fading undergone by a signal transmitted from the i-th transmit antenna to the j-th receive antenna, and is modeled as a zero-mean independent complex Gaussian random variable with $E|\alpha_{i,j}|^2=1$.

12. The receiver according to claim 7, wherein each of the plurality of

received data processing units comprises:

a demodulator for demodulating the received data;

a plurality of first multipliers for multiplying an output signal of the demodulator respectively by corresponding spreading codes of the PN sequences;

a plurality of accumulators for accumulating data output from the plurality of first multipliers over a PN sequence length, respectively;

a plurality of second multipliers for multiplying output signals of the plurality of accumulators by complex conjugates of fading coefficients according to path gains; and

a plurality of real part selectors for taking real parts of signals output from the plurality of second multipliers, respectively.

13. The receiver according to claim 7, wherein the space-time decoder is a space-time Viterbi decoder that performs decoding using a branch metric.

14. The receiver according to claim 13, wherein the branch metric is expressed by $\sum_{j=1}^{m}\sum_{\tau=0}^{N-1}\left|\gamma^{j}(t,\tau)-\sum_{i=1}^{n}\alpha_{i,j}c^{i}(t,\tau)\right|^{2}$, and

wherein the space-time Viterbi decoder searches for a path having the lowest accumulated metric.

15. The receiver according to claim 14, wherein, when correlation

between the PN sequences is negligible, the highest value from among values expressed by $\sum_{i=1}^{n}\sum_{j=1}^{m}\mathrm{Re}\{\alpha_{i,j}^{*}\sum_{\tau=0}^{N-1}\gamma^{j}(t,\tau)c^{i*}(t,\tau)\}$ is calculated to simplify the branch metric.

16. A transmitting method in a Direct Sequence Code Division Multiple Access (DS/CDMA) system, the method comprising:

receiving data from a data source;

generating multiple Pseudo ~~random~~ Noise (PN) sequences;

selecting two PN sequences from the multiple PN sequences to construct Space-Time Trellis Codes (STTC);

space-time encoding data received from the data source according to the space-time trellis codes to output an M-ary data symbol; and

modulating each of the space-time encoded data according to the space-time trellis codes and wirelessly transmitting the modulated data.

17. The transmitting method according to claim 16, wherein the generation of the multiple PN sequences includes generating M/2+1 PN sequences for the space-time encoding.

18. The transmitting method according to claim 16, wherein the selection of the two PN sequences from the multiple PN sequences to construct the space-time trellis codes includes receiving $\log_2 M-1$ bits from the

data source.

19. The transmitting method according to claim 16, wherein the space-time encoding of the data received from the data source according to the space-time trellis codes includes selecting two PN sequences from the multiple PN sequences and space-time encoding $\log_2 M$-1 bits.

20. The transmitting method according to claim 16, wherein the modulation of each of the space-time encoded data according to the space-time trellis codes includes determining polarity of parallel transitions using one bit from among $\log_2 M$ bits and modulating each of the space-time encoded data according to the determination.

21. A receiving method in a Direct Sequence Code Division Multiple Access (DS/CDMA) system, the method comprising:

receiving a space-time encoded signal through multiple paths;

despreading the received signal into a plurality of PN sequences;

multiplying the PN sequences respectively by complex conjugates of fading coefficients, and taking real parts of the multiplied PN sequences;

combining signals of the real parts into a signal; and

decoding the combined signal.

22. The receiving method according to claim 21, wherein the decoding of the combined signal is performed using a branch metric.